

client assistance memo

Sustainable Building and Reuse of Building Materials

May 2001

What does it mean to build “sustainably”?

Sustainability was defined by the World Commission on Environment and Development in 1987 as “meeting the needs of today without compromising the ability of future generations to meet their own needs.”

Building sustainably means using building methods and materials that promote environmental quality, economic vitality, and social benefit through the design, construction, operation, maintenance, and deconstruction of the built environment. Sustainable building attempts to consider the environmental, economic, and social impacts of a construction project as an integrated whole rather than looking at these areas individually.

Some features of sustainable buildings typically noticeable to end users include the integration of natural daylight for lighting purposes, high indoor environmental air quality, and reduced utility bills. Sustainable features that may not be noticeable include use of finishes and materials low in volatile organic compounds that improve indoor air quality; increased productivity of building occupants due to healthier workplaces; reduced impact of building construction on the environment through careful construction planning; use of locally produced materials to support the local economy; and enhanced social interaction through community involvement in building planning and operation.

What is DPD’s role in “building sustainably”?

Sustainable development involves elements of both the Land Use Code and the technical construction codes. Seattle’s Comprehensive Plan and neighborhood planning efforts, which incorporate many sustainable

community and design elements, are the primary drivers of sustainable land use development policies that promote urban density and use of public facilities. With regard to construction, building sustainably does not necessarily present unique building code problems. A common misconception is that sustainable design and construction choices require special approval by DPD; typically they do not, but they do require building designers and owners to make decisions regarding project development that are informed by sustainable development principles. If a proposed sustainable design feature or building technique presents a unique code issue, DPD is equipped to address such issues, typically under the alternative materials and methods sections of building codes.

An important part of sustainable building is how efficiently buildings use energy. Seattle has a long history of progressive programs to achieve energy efficiency. The Washington State Energy Code with Seattle amendments is considered by building professionals across the country to be one of the better examples of a state and local energy code.

For design decisions that involve multiple aspects of sustainable building, such as reusing materials combined with building an energy efficient structure, careful judgments must be made. For example, reusing old single-pane windows and frames may initially seem to be a sustainable building practice, but thinking in terms of the life cycle of a new building may paint a different picture of the relative sustainability of reusing the old windows. The cost and environmental impact of additional energy generation for the energy lost through the old window must be compared with that of a new double-pane window with a low-emissivity coating in an energy efficient frame.

Other factors to be considered would be the relative environmental benefits gained or lost from producing a window with virgin versus recycled materials, and whether new windows could be produced locally, thereby supporting the local economy and reducing transportation impacts. Consequently, as will be shown in the discussion below regarding reuse of building materials, the Energy Code may allow reuse of

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energy inefficient building components in a few cases, but is generally biased towards replacing inefficient components with efficient ones.

REUSE OF BUILDING MATERIALS: Frequently Asked Questions

Following are a series of questions and answers regarding one aspect of building sustainably - reuse of building materials.

What is DPD's general policy on the reuse of building materials?

Materials may be freely reused unless one of the building codes imposes a specific requirement that the reused material would not otherwise meet. For example, non fire-rated drywall in good condition may be reused except where fire-rated construction is required. Where a specific code requirement exists, applicants should consult Seattle Building Code Sections 104.14 and 104.15 or meet with a building official to discuss the proposed reuse of materials. In practice, applicants are more likely to use Section 104.15 than Section 104.14 for approval of reused building materials.

Seattle Building Code Section 104.14 states that the building official may modify the requirements of the Building Code for individual cases under certain limited circumstances. Seattle Building Code Section 104.15 states that the Building Code “does not prevent the use of any material, design, or method of construction not specifically allowed or prohibited in the code, provided the alternate has been approved and its use is authorized by the building official.” For the use of alternate materials, including reused materials, DPD generally requires applicants to provide formal technical justification. This applies to all portions of the Seattle Building Code, but most directly bears on fire, life safety, and structural elements. In some cases (see below) less formal technical justification is possible.

What types of reused building materials would concern DPD?

DPD is most concerned about materials that directly relate to life safety and structural issues, particularly issues that relate to a clearly defined standard in the code. Examples of material reuse that require approval are:

- reusing a door as a stairway enclosure door that lacks a fire door test label;

- reusing ungraded timbers for structural support in a new building.

Is there a process for handling those concerns?

Yes, SBC Section 104.15 mentioned above. It generally requires knowledgeable professionals to request use of alternate materials and justify equivalency to the general intent of the code.

What types of reused building materials would not be of concern to DPD?

DPD would tend to be less concerned about reusing building materials in non-structural applications or in a way that does not have a direct connection to fire and other life safety issues. In some cases, attributes of the building may have a positive affect on the reuse of a material; for example, reuse of ungraded structural lumber in situations causing only moderate stresses. In other cases, there may be negative effects, such as an energy use (see section below).

Does it make a difference if the material is salvaged from an existing structure on-site or from a building salvage yard?

Yes, it is important to know from where the material came. For example, one would have more knowledge about a steel column from a known building within the jurisdiction. Another steel column of unknown origin may have been over-stressed in an industrial use in the past, may be more questionable with regard to steel grade, or may have been exposed to industrial chemicals or other abuse.

What role do the plans examiners and inspectors play in approving the reuse of building materials?

Plan examiners judge the acceptability of the applicant's request to use alternate materials. Inspectors or a DPD-required independent third party inspector or testing agency approve the condition of construction materials, both new and reused.

Do salvaged timbers need to be graded? Is an engineer's stamp required? May default grade values be assumed?

No default grade values exist for salvaged timbers. If

a 24" X 24" heavy timber column that came out of an old mill building is proposed for use in a new one-story restaurant building, the Department's concern about grading isn't high if the calculated stresses are much less than common allowable stresses for graded heavy-timber columns. In such a case, DPD is likely to accept the designer's opinion of the timber's adequacy. On the other hand, if a designer proposes to frame a new warehouse building roof with unmarked timbers from an unknown source, DPD is likely to require an engineer's report and/or a report from a timber grader.

Generally conservative design values should be used when reusing structural members, but DPD's acceptance of such an approach will be on a case-by-case basis because it doesn't really matter how conservative the design is if the wood in question is decayed or damaged.

Following is some general guidance regarding reuse of wood in specific applications for Single Family dwellings:

- studs reused in bearing walls—engineer's stamp required on plans or report
- studs reused in non-bearing walls—OK if lumber to be reused is in good condition
- joists, rafters, beams—if grade called out on the approved plans (e.g., Fir grade) - engineer's stamp required; other situations - OK if in good condition
- sheathing—OK if in good condition UNLESS used in a required shear wall

Are there default fire ratings for certain types of doors?

There are no default fire ratings for doors. If a door is required to be fire-resistance-rated, it must be tested by an approved testing agency. However, if an old door is very similar or nearly identical to a new door with a fire rating, you might consider discussing the possibility of using the old door with DPD. Fire-rated doors have been around for a long time now, so there may be a supply of used rated fire doors available at local building material salvagers. Solid-core wood doors 1-3/4 inch thick or thicker are generally good for situations requiring "1-hour" doors. Before installing a used fire-rated door, consult with DPD regarding the

door's acceptability. (See also the following Energy Code questions on exterior doors.)

REUSE OF BUILDING MATERIALS: Energy Code Related Questions

The following questions focus on how the Energy Code may affect the reuse of such building components as windows, doors, HVAC, and lighting equipment. Chapter and section numbers refer to the Washington State Energy Code with Seattle Amendments, unless otherwise noted.

For the building envelope, including windows and doors, an applicant may show Energy Code compliance by using one of the following three methods: the "prescriptive" path, the "component performance" (Target UA) path, or the "annual energy analysis" path.

The prescriptive path is the simplest and involves merely complying with the minimum insulation R-values, maximum glazing U-factors, and glazing percentage specified in Energy Code Chapter 6 for residential buildings and Chapter 13 for nonresidential buildings.

The component performance path and the annual energy analysis path offer more flexibility in design, but are more complicated and require detailed calculations or computer modeling and analysis.

For HVAC systems and equipment, there are two compliance options with the prescriptive requirements specified in Section 503 for residential buildings and Chapter 14 for nonresidential buildings. For lighting equipment and systems, there are no requirements for residential occupancies. For other spaces, including parking garages, the requirements are in Chapter 15.

May old single-glazed or double-glazed windows be reused if a storm window is added?

Yes, but in most cases calculations must be done and improvements made in other areas to compensate for the additional heat loss. Double-glazing has been required in Washington State since 1980. The majority of new windows in both residential and nonresidential buildings now has double-glazing with a special low-emissivity coating that makes the window perform as if it had three layers of glass. An old single-glazed window with storm window added is still less energy efficient than a new window.

For small additions, where the designer wants to match other existing windows, it may be worth the effort to do the calculations and add the necessary insulation to the existing roof and floor to compensate for the inefficiency of the old windows. For large additions and new buildings, you are generally better off taking advantage of the new technologies.

May a default U-factor be assumed for salvaged residential thermal-pane windows?

Yes. The Washington State Energy Code Table 10-6A provides default U-factors for uncertified windows and doors used in residential spaces. By providing default U-factors, the Energy Code provides a mechanism by which unrated glazing products can be compared with rated products.

For example, an uncertified wood or vinyl frame window with double-glazing and less than 1/2 inch air space between panes of glass is assigned a U-factor of 0.63. While this window would not comply with any of the prescriptive options for spaces with electric resistance heat, it would comply with the vertical U-factor requirement for several of the options for residential spaces heated by other fuels found in Table 6-2. The same window with a metal frame is assigned a U-factor of 0.92, which means the unit would not comply with any of the options in Table 6-2. To use these windows, the applicant would need to show Energy Code compliance using the component performance path of Chapter 5 to compensate for the energy loss through the poorer-performing window.

For uncertified windows to be installed in nonresidential spaces, Table 20-6 provides the default U-factors and Table 13-1 lists the prescriptive options. Note that there are requirements for both U-factor (heating) and Solar Heat Gain Coefficient (cooling). Section 1330 contains the trade-off methodology.

Are there default U-factors for certain types of doors?

The Energy Code provides default U-factors for unrated residential wood and steel doors in Table 10-6C. For example, a 1-3/8 inch wood door with 7/16-inch panels and storm door is assigned a U-factor of 0.33, which meets most residential prescriptive path options in Tables 6-1 and 6-2. The same door without a storm door is assigned a U-factor of 0.57, which means the designer would need to follow the component performance compliance path of Energy Code Chapter 5 to

make up for the energy loss through the poorer-performing door.

NOTE: Section 602.6 of the Energy Code allows installation of one unlabeled door (up to 24 square feet in area) in residential spaces.

For uncertified doors to be installed in nonresidential spaces, Table 20-6 also provides the default U-factors and Table 13-1 again lists the prescriptive options. Note that if the door is more than one-half glass, it is considered glazing. Section 1330 contains the trade-off methodology.

May HVAC equipment be reused?

No, for most equipment. Equipment may be reused if it meets the current minimum efficiency standards in Washington State Energy Code Chapters 5 and 14. There have been improvements in efficiency for most heating and cooling equipment, so most older equipment does not meet the new standards. Components such as ductwork and piping, however, do not have minimum efficiency. As far as the Energy Code is concerned, they may be reused provided that the correct amount of duct or pipe insulation is installed.

May lighting fixtures, lamps, and ballasts be reused?

Yes, for residential spaces, but again, think about the life cycle energy and environmental impacts of using an inefficient lighting system. The Washington State Energy Code does not establish energy efficiency requirements for residential lighting systems and equipment. However, the availability, price, quality, and variety of compact fluorescent bulbs and high-output halogen lamps on the market today offer excellent alternatives to the use of traditional incandescent lamps. In addition, City Light also offers incentive programs for installing energy-efficient lamps and appliances in multifamily developments.

They may also be reused for nonresidential projects if you are willing to do some calculations and if you are willing to specify light colored surfaces so that you get the most benefit from less-efficient older equipment. Here again, however, there have been significant improvements in technology.

Fixtures with open parabolic louvers direct more of the light into the space with less being trapped in the fixture. Even among fluorescent lamps, the older T-12 (1-1/2 inch diameter) lamps have been replaced with skinnier T-8 (1 inch diameter) and now T-5 (5/8 inch

diameter) tubes that have better phosphors and trap less light within the lamp. The older magnetic ballasts are quickly being replaced with electronic ballasts that are more efficient and offer the potential to dim the lamps for daylighting control.

Chapter 15 of the Energy Code provides two compliance options: prescriptive and lighting power allowance. The prescriptive option requires efficient fixtures, lamps, and ballasts. Most older fixtures, lamps, and ballasts will not comply with these specifications.

The lighting power allowance option, on the other hand, allows the use of any equipment as long as the installed lighting wattage does not exceed the maximum values in Table 15-1. However, be aware that this option still requires reasonably efficient lamps. It may be possible to mix in a few incandescent lamps, but it will not be possible to comply using only incandescent lamps.

Getting More Information

For more information about how to build sustainably, contact DPD's Sustainable Building Program staff at (206) 684-0806 or visit the following websites, each of which contains links to dozens of other resources:

- DPD's own Sustainable Building website * **
www.seattle.gov/dpd/sustainability
- Business and Industry Resource Venture * **
www.resourceventure.org
- Construction Recycling Directory
http://dnr.metrokc.gov/swd/bizprog/sus_build/CDLguide.pdf
- Environmental Building News
www.buildinggreen.com
- Northwest Ecobuilding Guild
www.ecobuilding.org
- Reusable Building Material Exchange *
www.rbme.com
- Seattle City Light's Sustainability Page
www.seattle.gov/light/conserve/sustainability
- Seattle Public Utilities Sustainability Page
www.seattle.gov/util/RESCONS/susbuild
- "Use It Again, Seattle" Directory *
www.seattle.gov/util/useitagain
- United States Green Building Council
www.usgbc.org

* Resources marked with an asterisk are likely to be

the most helpful for Seattle building owners, designers, and builders.

**** The Business and Industry Resource Venture (BIRV)** provides free technical assistance to Seattle building owners and tenants, architects, and contractors who are interested in sustainable building design and construction. Specifically, they provide assistance on waste prevention and recycling, using recycled building materials, water conservation, and stormwater management. Phone: (206) 389-7304

This Client Assistance Memo (CAM) will be updated as necessary to include the latest information and guidance available regarding the relationship between DPD and building sustainably. In addition, the following CAMs address topics and issues relevant to building sustainably:

- CAM 234: Landscaping Information
- CAM 238: Design Review: General Information, Application, Instructions, and Submittal Requirements
- CAM 417: Sun Chart: Determination of Solar Exposure
- CAM 419: Commissioning for Nonresidential Mechanical and Lighting Systems

Getting Technical Assistance from DPD

DPD provides a technical backup service to answer explicit Building Code and Energy/Mechanical Code questions. Technical backup plans examiners are available to walk-in customers on a first-come, first-served basis during normal working hours at the DPD Applicant Services Center, located on the 20th floor of Key Tower, 700 Fifth Avenue. Technical backup is also available by phone from 1-4:15 p.m. daily:

Building Code—(206) 684-4630

Energy/Mechanical Code—(206) 684-7846

Access to Information

Links to electronic versions of DPD publications are available on the "Publications" page of our website at **www.seattle.gov/dpd**. Paper copies are available from our Public Resource Center, located on the 20th floor of Key Tower at 700 Fifth Avenue in downtown Seattle, (206) 684-8467.